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BEEKEEPING IN ARKANSAS

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Fayetteville, Arkansas.

BEEKEEPING IN ARKANSAS

W. J. BAERG

Beekeeping as an industry should receive more attention in Arkansas. Any locality in the state will support a few colonies of bees, and such regions as the holly belt in the southern part of the state and the Mississippi river bottoms in the eastern part of the state will support a large number of colonies of bees and make beekeeping a very profitable pursuit.

By encouraging people to become beekeepers, we do not mean "bee owners." Bees must be kept; not merely owned. Not only are apiaries belonging to such owners a dead investment; but they are actually a serious menace, because highly infectious brood diseases are allowed to proceed unchecked, and the neglected apiaries serve as centers of infections in the entire neighborhood.

STATUS OF BEEKEEPING IN ARKANSAS

According to reports of the United States Department of Agriculture there were in 1918 83,458 colonies of bees in the state. Iowa and Missouri offering no better opportunities have about twice the number of colonies in Arkansas. In these reports we learn also the unpleasant fact that Arkansas beekeepers lose annually sometimes as high as 25 per cent of their colonies on account of starvation. Another item in the reports explains this tremendous loss by the fact that bees are given no winter protection in this state. To reduce these extensive losses and to aid in the growth of one of the most profitable industries of the state is the purpose of this bulletin.

THE VALUE OF BEES

According to a conservative estimate considerably more than one-half of the nectar secreted by plants in the United States every year is lost. Bees are the only agency that man has by which he can appropriate for himself this valuable plant product and have it made into one of the most delicious, nutritious, and readily digestible of all foods.

The peculiar advantages of beekeeping are seldom sufficiently realized. It does not require an investment in land, nor in expensive equipment. Any man or woman who has the aptitude can learn to make money in the production of a food material that almost always can be sold at a handsome profit, and that during a temporary depression of prices can be kept in a good marketable condition, even from year to year if necessary.

A crop of honey is not all that is to be gained from beekeep-

ing. To the fruit grower, the truck gardener, and the cotton grower bees may be more valuable in the aid of securing a crop than for honey production.

It has been experimentally proved that the production of most varieties of apples, pears, plums, cherries, raspberries, and gooseberries depends upon the transmission by insects of the fertilizing pollen from flower to flower of different trees or varieties. Among the various insects that assist in the transferring of pollen, the honey bee is certainly the most important single agent. Fruit growers in California seem to have realized this, since many of them pay the beekeepers from two to five dollars for each colony of bees placed in the orchard.

Recent experiments have brought out the fact that cotton, especially long staple varieties, depends to a considerable extent on insects for pollination. It is recognized that growers of long staple varieties of cotton will find beekeeping a distinct advantage to the cotton crop. In regard to the value of cotton as a honey plant the reader is referred to page 30.

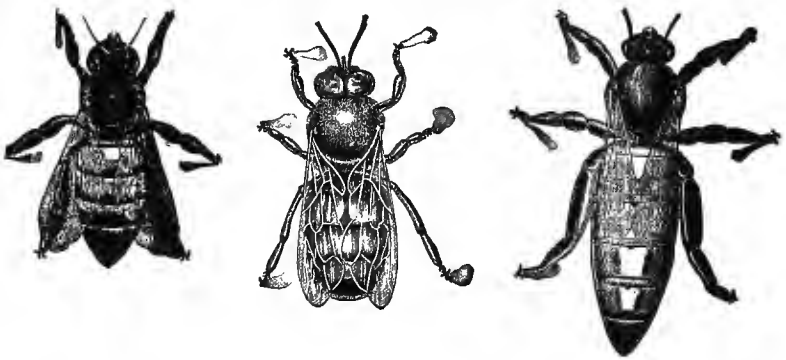
There is an old theory that bees will injure ripe fruit, especially grapes. This supposition is entirely unwarranted as has been shown by many investigators. That bees will not injure the skin of sound fruit can be determined by anyone by placing sound fruit in a hive, where it is surrounded by thousands of bees. It will be found that the fruit remains uninjured. Ripe fruit is often injured by birds or wasps, and bees will try to secure the fruit juice that would otherwise be lost.

THE COLONY

A colony of bees consists normally of one queen, who is in nowise the ruler, but who is the mother of the colony, a number of workers, and in the summer, a few hundred drones or males. The number of workers in a colony varies between wide limits. These limits have been given as from 1,000 to 50,000. However, strong colonies, colonies that will store an abundant surplus, should have as many as 80,000 or 100,000 workers.

The Queen. Under normal conditions there is but one queen in a colony. She is the only perfect female. She is larger than the other bees, her abdomen is longer than that of the workers and her wings are shorter in proportion to those of the worker. The queen has a curved sting which, as a rule, she uses only in killing other queens. Her only task is that of laying eggs in that part of the hive used for rearing brood. The number of eggs laid in a day varies with the different seasons. At the height of brood rearing as many as 3500 eggs may be laid in a day. A queen may live four or five years, but as a rule she cannot perform her task satisfactorily longer than two or three years. A virgin queen leaves the hive four or five days

after she has emerged and during her flight mates with one of the drones. The drone dies as a result of mating and the queen is now fertilized for life, or perhaps better, for her entire period of usefullness. She does not as a rule leave the hive again except in case of swarming, when she leaves with the swarm. It



A B C

FIG. 1. A. Worker, B. Drone, C. Queen.
(From "A B C and X Y Z of Bee Culture")

has been held, and is still held by many text book writers that the queen can control the fertilization of the eggs that she is laying. It is well known that the drones hatch from eggs not fertilized and the workers from fertilized eggs. The significance of this is that in the light of these facts the beekeeper can establish pure stock more readily than in the case of poultry or cattle. If, for instance, he introduces an Italian queen that has mated with an Italian drone all the virgin queens reared will be pure Italian. If these mate with black drones, as may happen, the workers will be a mixture of Italians, blacks, and hybrids but the drones will be pure Italians, (because they receive none of the male characters), then if later more Italian queens are reared they mate with the Italian drones and pure Italian stock is the result.

When a queen ceases to perform her duty properly or dies for some cause or another, or when the bees are preparing to swarm, the workers proceed to rear another queen. The egg from which the queen is reared is one that would ordinarily develop into a worker, that is, it is fertilized. This egg, or a worker larva less than three days old is placed in a specially constructed cell somewhat resembling when completed a small peanut, and the larva, or larvae, since the colony usually rears a number of these when there is need for a queen, are fed on royal jelly. This is predigested food produced from a mixture of honey, pollen, and a secretion from glands in the head of workers. At the

end of six days the young larva is full grown and the cell is now sealed up. After seven more days the larva has passed thru its transformation and the fully developed queen is ready to emerge. The queen that emerges first may destroy all the others in their cells.

The Workers. The workers furnish all the labor for the colony. The development of the worker from the egg till it is ready to emerge is 21 days. Young workers, up to two weeks old, are employed feeding the larvae, secreting wax, and building combs. When the workers have reached the age of seventeen days they begin to gather nectar and pollen. A few of the workers are used as guards, guarding the entrance against intruders.

The workers are the smallest individuals of the colony. They differ in appearance from the drones in having a pointed abdomen while that of the drones is blunt at the posterior end. The workers are equipped with a sting, the purpose and effect of which is well known to all of us who have come in contact with bees.

The length of life of a worker is not measured in time but in the amount of work done. Workers emerging late in the fall live thru the winter, while those emerging shortly before a heavy honey flow live only about six weeks.

The Drones. The drones are the males and their only function is to mate with virgin queens. The drones usually appear in April and May at the height of brood rearing. They are larger than the workers and clumsy in appearance.

Drones develop from unfertilized eggs. For three days after hatching the larvae are fed on the same material as are the workers and queens; after that the food consists of a mixture of half-digested pollen and honey. The development of the drone requires 24 days.

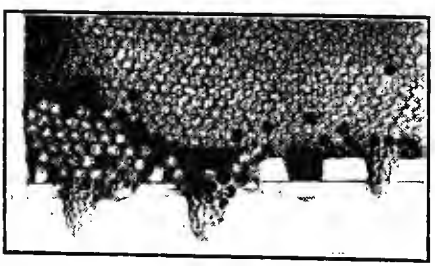


FIG. 2. Drone cells in the lower left hand corner, queen cells below. The others are worker cells. (From Sladen, "Bees and How to Keep Them")

The drones have no sting and are therefore quite harmless. They are also rather helpless creatures. They seem to be able

to take honey from the cells and feed, but pollen apparently must be fed to them by the workers. The workers realize that the drones are a considerable drain on the colony, for whenever the honey flow comes to a sudden decline, or in case of a fall in temperature the drones are driven from the colony, so as to reduce the cost of living. Drones are not distinctly members of a certain colony; they are allowed to enter any colony without being molested by the guards, excepting, of course, during the time when drones are being driven out by the workers.

RACES OF BEES

A number of different races have been tried out in the United States, the more important among which are the Italian, German, Caucasian, Carniolan, and Cyprian.

Italian. The name of the race indicates its origin. It is the most popular race among American beekeepers. Various strains of this race have been developed, which are designated by various trade names. The typical Italians, commonly known as three banded, are considered the most desirable for commercial beekeeping. The Italian bees are preferred to all other races because they build few queen cells, keep the hive clean, and drive out wax moths; they do not run on the combs, and they swarm less than the Carniolans; they are quite gentle, and are easily subdued by smoke. Most important of their charactersitics is the resistance to European foul brood. In this respect they are vastly superior to the German or black bees.

German. These are generally known as "black bees". They are considered undesirable because they are less prolific than the Italian, they do not keep the hive clean, and they swarm more than the Italian. While they can be subdued with smoke, they are much more difficult to handle than are the Italian. The most undesirable feature of the German bees, however, is that they succumb very readily to European foul brood. This disease when once introduced into an apiary of German bees is very difficult to eradicate.

Caucasian. The color of this race depends on the region from which they come. The abdomen may be black or gray, or it may have three yellow bands very similar to those of the Italians. The Caucasian are perhaps the most gentle bees of all that have been tried out in America. They have, however, serious faults, on account of which most beekeepers who have tried them have abandoned them. They bring in and use freely a large amount of propolis (a sticky substance collected from the resinous buds of various trees, notably poplar and sweet gum). They also frequently build burr and brace combs.

Carniolan. These come next to the Caucasian in gentleness. They swarm excessively, but they are good honey gatherers and it has been claimed that they resist European foul brood as well as do the Italian.

Cyprian. These resemble in appearance rather closely the Italian but are lighter in color. The queens are very prolific. The bees winter well but may wear themselves out by brood rearing in the winter. The workers are very pugnacious and cannot be subdued by smoke. Altho formerly widely advertised, the Cyprian have been almost totally abandoned because they are difficult to handle.

LOCATION OF THE APIARY

In choosing the site for an apiary there are at least four fundamental points that must be considered. These are shade, fresh water, protection from strong winds, and sufficient pasturage.

It is considered desirable to have the hives exposed to the sun during the early morning hours; but during the hottest part of the day the hives must be shaded, for the combs are likely to melt, and the brood to die. Then too, many of the bees are required for fanning the brood; others loiter around the hive, loafing instead of gathering nectar.

Brood rearing requires a constant supply of fresh water. This should be near the apiary and may be in the form of a small stream, a dripping hydrant, or anything that will furnish a constant supply of fresh water without drowning the bees. A vessel filled with water with a lot of chips or pieces of cork floating on it will serve very well.

Protection against strong winds is essential. If the apiary is located in the open, a windbreak as well as shade must be provided. Many beekeepers prefer to have the hives facing east or southeast, this, however, is probably not of very great importance. The essential thing is that the entrance should not face north or southwest; neither should it face the prevailing wind. if the hives are arranged in groups of four, the entrances should face east and west.

To avoid dampness the hives should not be placed directly on the ground but should be raised four or six inches, using bricks or regular hive stands as a foundation. The rear end of the hive should be one or two inches higher than the entrance so that rain coming thru the entrance may readily drain off. All grass and weeds should be kept cut low in order to allow the bees free flight to and from the hives.

If beekeeping is to be commercially profitable, the available nectar supply is a very important consideration. Any locality in the state will supply nectar for a few colonies, tho the surplus

may in some localities not be very large. If possible the apiary should be located in the heart of a region yielding an abundance of at least one or more of the important plants of the state from which surplus honey can be produced. Among these are sweet clover, fruit bloom, white clover, Bidens (Spanish needle),and holly. Bees will travel four or five miles in search of nectar, but they will probably not lay up any surplus honey when obliged to go more than a mile.

In the regions of Arkansas most favorable to honey production, such as the counties of the northeastern corner and the counties lying in the holly belt in the southern part of the state, an apiary may consist of 100 or perhaps more hives. In the remainder of the state apiaries would perhaps better be limited to about 50 colonies. Different apiaries should be about two miles apart.

BUYING BEES

Bees may be bought by the pound from dealers. The names of such dealers can be obtained by writing to the Experiment Station, or by referring to such periodicals as the "American Bee Journal" published at Hamilton, Illinois, or "Gleanings in Bee Culture" published at Medina, Ohio.

It is, however, much more economical to buy bees from a beekeeper in the neighborhood. A colony of good Italian stock in a frame-hive can often be bought for two or three dollars. A beginner in beekeeping should buy only a few colonies, five or six, and if possible should secure these in modern 10-frame hives. If the bees are in box hives they should be transferred to modern hives as soon as possible (see p. 11 for transferring bees.) In transporting bees on a wagon or truck, if the weather is cool, the bottom and cover are fastened by means of a rope or wire and the entrance is closed by nailing over it a piece of screen wire. If the weather is hot, hauling should be done at night, and the top cover should be replaced by a piece of screen wire. On the wagon or truck the hives should stand crosswise to the length of the wagon bed. This will help to prevent the combs from breaking loose on account of the jarring on the road.

If the bees are in hives with movable frames, the buyer should insist on examining all the colonies that he intends to get. If the cappings of the cells appear to be sunken or show irregular holes in them, or the larvae in the cells have any other color than pearly white and appear shrunken, the bees are very likely to be infected with foul brood and will die out in a short time unless the proper treatment is administered. (See p. 25 for foul brood). If bees are moved into another locality over a distance of more than two miles, no precautions need be taken to prevent them from going back to their former location. If

they are moved less than two miles, the bees should be made aware of the change by the placing of some brush or other obstruction in front of the entrances. The change in appearance of the surroundings will prevent the bees from leaving the hives before observing carefully the new location.

EQUIPMENT

Hives. The use of modern equipment cannot be urged too strongly. With the use of good equipment and a little care, a maximum yield of honey can be secured, while without such equipment it is practically impossible to get anything like a good crop of honey. Among the various articles constituting the equipment, the hive is by far the most important.

Beekeepers of many years' experience and other authorities agree that the eight-frame hive is too small. It seriously limits the size of the colony and causes much unnecessary swarming.

The hive generally recommended at this time is the standard 10-frame hive. Many beekeepers feel that even this size is too small for a brood chamber; so they use two hive bodies for the brood chamber. Still others are using larger hives, such as the Dadant or the Jumbo. It is possible that these larger hives will take the place of the 10-frame standard hives that are now rather generally used.

The movable, self-spacing frames are absolutely essential. In regions where the bees gather considerable propolis, the metal-spaced frames are very desirable. Only by the use of movable frames can the colonies be properly observed and cared for. Without them beekeeping cannot be made profitable. The use of full sheets of foundation in the brood frames as well as the extracting frames must be insisted on. These full sheets of foundation insure straight combs and they prevent the bees from building a large number of drone cells. Even if foundation costs about 85 cents a pound, it is cheaper to buy it than to let the bees build it. It costs the bees about 10 pounds of honey to build one pound of comb. At this rate foundation will cost at least two dollars a pound, not to mention the crooked combs and excessive drone population. The use of one inch starters is a waste of time and expense.

Many beginners in beekeeping hesitate in buying standard equipment on account of high prices. It is true that the hives and other equipment required for even five or six colonies of bees represent a considerable investment for a person of small means. However, if it is borne in mind that this equipment when properly cared for lasts for a long time one can easily understand that the investment is a good one. A hive properly painted and placed on bricks or other support will last almost a life time.

The frames can be used until they are broken thru carelessness. Other equipment, such as veil, smoker, hive tool, honey board or queen excluder, bee escape, wire imbedder, uncapping knife, and bee brush, is quite essential and will add very considerably to the pleasure and profit in beekeeping. All the articles mentioned above are well illustrated and described in catalogs of beekeepers' supplies (see page 32); so just a few suggestions will suffice here.

In purchasing a smoker, the small sizes should be avoided; the large or medium-sized ones are much more servicable. With reference to a honey board or queen excluder, the perforated zinc boards are not recommended. A six or seven wire-and-wood honey board is much more desirable. Wearing a veil in the apiary does not show fear, but good management. Veils made of silk tulle are preferred by many beekeepers. Veils made of screen wire will last much longer. They can be kept away from the face and neck better; but they do not feel as comfortable as do the silk tulle.

TRANSFERRING BEES

When bees are purchased in box hives they must be transferred to modern hives. A good time for transferring is immediately before a good honey flow, such as comes during fruit bloom, sweet clover, or Bidens (Spanish needle). It should be done on a bright, sunny day when many of the bees are in the field.

The method of transferring most commonly used is as follows: A few puffs of heavy smoke are blown into the box hive; it is then set a few feet to the side, the top is torn off, and an empty box having the same length and width as the box hive is placed over the box hive. With two sticks the hive is now beaten vigorously on the sides for ten or fifteen minutes. This drumming will induce the bees to leave the hive and cluster in the box above. From this box the bees are shaken into the new hive placed in the position of the box hive, or preferably in front of the new hive so that the queen can be seen to enter. The hive should be equipped with movable frames and *full sheets of foundation*. If available, it is well to put into the new hive a frame from another hive containing some brood and honey. This should be placed in the middle of the new hive. If no nectar is coming in at the time of transferring it will be necessary to feed the bees as described under feeding. (See page 19). The brood remaining in the old box hive may be saved by putting this hive aside and contracting the entrance to an opening thru which only one or two bees can pass at a time. After twenty-one days all the brood will have emerged and these bees may be added to those already transferred by shaking them in front of the new hive. Both colonies should be smoked liberally to avoid fighting.

Among the young bees that are being transferred there may be one or more queens. These should be located, or kept from entering the new hive by means of an alley trap.

To save the combs when transferring bees is a somewhat disagreeable task, yet many beekeepers prefer to do this rather than render them to wax. To fit the combs into the new frames (without foundation) a large piece of comb is cut from the box hive and placed on one of the frames and then cut so that it will fit into the frame. In cutting the combs the drone comb should be eliminated. The combs fitted into the frame are easily held in place by two or three thin wires or pieces of string tied around the frame. In transferring, the bees are made to go through an experience very much like that of swarming. The smoke and drumming causes them to fill up on honey, go up, and cluster in the empty box. For this reason bees that have been transferred go to building combs, and storing honey with a very much increased vigor, just as in the case of swarming.

More detailed information can be obtained by referring to special bulletins on this subject or to one of the several text books on beekeeping.

GENERAL MANAGEMENT

Proper management of bees is based on knowledge of bee behavior. Bee behavior means the response that bees make to different environmental factors such as weather conditions, nature of the hive, etc. The response of bees is always in the form of a motion in so far as man knows. We don't know whether bees think or not; but we can observe their motions.

The lack of an adequate knowledge of bee behavior causes Arkansas beekeepers to lose about twenty-five per cent of their bees on account of improper protection during the winter. For the same reason many colonies are lost thru European foul brood. For the same reason many beekeepers are seriously troubled with wax moths. Failure to study bee behavior causes beginners to try to produce comb honey which usually results in a total failure.

Handling Bees. The ability to handle bees cannot be secured by reading books or bulletins; it is acquired by experience. However, a few suggestions may lessen the number of mistakes of beginners. Bees are not partial to a certain person, one man can handle them as well as another. They resent interference and are especially irritated when the intruder makes sudden movements. The best time to open hives is during a warm and sunny day. Bees should not be disturbed late in the evening, when it is cold, or during a rain.

Stings should be avoided by a judicious use of the smoker, and a veil; the odor of the poison irritates the bees and causes

much unnecessary trouble. Good fuel for the smoker consists of burlap, dry rotten wood, or dry bark.

Standing or placing anything in front of the hive should be carefully avoided. For this reason the practice of blowing smoke into the entrance is not recommended, tho it may often be necessary. A little smoke blown over the frames immediately after lifting one corner of the inner cover, with a few additional puffs from time to time will usually serve to keep the bees in good humor. Smoke is not a narcotic; it alarms the bees and causes them to fill up on honey, and throws into confusion, more or less, the organization of the colony. Bees when they have just filled up their honey stomachs are not so apt to sting as they are otherwise. Smoke must be used with discretion, too much of it is likely to irritate the bees.

An important consideration in handling bees is that one must work slowly, and deliberately, avoiding all sudden movements. The frames are best loosened with a hive tool, though a screwdriver will do. If a number of frames are to be examined, the first one is stood up on end leaning against the outside of the hive. Care must be taken not to place outside a frame holding the queen, for she may get injured or lost. In turning a frame so as to examine both sides, it should be held vertically and turned like a door on the hinges. This will avoid dripping of unsealed honey, and breaking of freshly built combs.

Spreading the brood. By a proper placing of the combs one is able to increase the amount of brood and thus help in developing a large working force for the honey flow. This is known as spreading the brood, that is, shifting towards the sides the frames containing larvae and eggs. To do this successfully *requires judgement* and *experience*. In the early spring during cool weather it is dangerous to spread the brood too much; it may readily become chilled and die. In a general way, spreading is accomplished by placing one or two empty combs in the center, next to these on both sides the sealed and emerging brood, and then the combs containing uncapped larvae and eggs.

Fall Notes. The season in which the beekeeper should start preparations for the following crop begins in August. In order to secure a maximum surplus of honey he must see to it that his colonies are vigorous and strong, consisting of at least 80,000 workers, at the time when the first strong honey flow is on. In order to accomplish this each colony must have in fall a young and vigorous queen which will not only maintain a sufficient number of workers to bring in the winter stores; but which will also produce a large number of young bees up to the time when the brood rearing ceases for the year. This is usually during October. All queens that are two years old or older,

or have been failing should be replaced by a young and vigorous queen of good Italian stock. If a colony goes into winter quarters with a strong force of young workers, and is well protected against extreme changes of weather, it will come thru the winter with a sufficient force to care for young brood and bring in stores. If in some sections of the state there should be a dearth of nectar the bees will need to be fed in the fall in order that young bees may be reared. Only the young bees live thru the winter. Unlike practically all other insects, bees do not hibernate during the winter. They remain more or less active, and consequently require stores in order to live. Contrary to a common belief, bees do not freeze to death; they either starve to death or wear themselves out trying to keep warm. Bees are much like a storage battery. They possess a certain amount of energy, and when this is exhausted they die. In a sense bees are coldblooded animals, that is to say, their body temperature is about the same as the outside temperature. Under winter conditions this statement must be modified. Whenever the temperature drops below 59 degrees Fahrenheit, the bees become active, generating heat to raise the temperature in the hive.

As already indicated the life of a worker bee is about five or six weeks of action, measured in amount of energy expended, rather than in time. If the bees are kept busy generating heat thru a large part of the winter, most of the workers will die before spring sets in.

There is another reason why bees need protection in winter. Warm weather continuing for several days will often stimulate brood rearing long before the first honey flow sets in. Often such warm weather is followed by severe cold spells, with a result that is rather disastrous. Adequate winter packing serves to protect the bees against extremes of temperature, warm as well as cold, and serves to delay brood rearing until the proper time for it has arrived, that is, after all danger of severe cold spells is past.

Winter Protection. A natural wind break, such as a thicket of blackberry or other shrubbery, an evergreen hedge, or such woods as will not allow the wind to sweep thru under the trees, is essential for proper wintering. It is absolutely necessary that the apiary be located in a place where the wind in winter is practically eliminated. Artificial windbreaks such as closed board fences often do more harm than good, by causing whirls that destroy many colonies. Buildings are also unsatisfactory since they usually serve only to divert the wind.

Probably the best method of protecting bees during the winter is according to the plan outlined in Farmers' Bulletin 1020 of the United States Department of Agriculture. Briefly this plan is as follows: The hives are arranged previously in

groups of four, two facing in an opposite direction from the other two, and about one foot apart. The winter case is best made out of 8-inch shiplap, large enuf to accommodate four 10-frame two story hives, with additional four inches of space below the hives, six inches around the sides of the hives (these are now placed close together) and 8 inches on top of the hives. All this extra space is filled up with sawdust, shavings, excelsior, or dry leaves. The entrance of the hives leads thru a tunnel and a series of holes bored in the side of the case to the outside. The top is covered with roofing paper and made so that the contents of the case will remain perfectly dry in all kinds of weather.

These wintering cases are being used at the experiment station and by a few of the beekeepers in the state. While they represent a considerable outlay, they also bring very good results, and if properly cared for will last for many years.

Various other methods of wintering, some of them less expensive than the one outlined above, are fully discussed in the books on beekeeping listed on page 32.

Winter Stores. An ample supply of winter stores is just as important as adequate protection. There must be a sufficient supply of stores to keep the bees thruout the winter, and also to meet the demand occasioned by early brood rearing. Thirty pounds of honey is often given as the amount necessary to keep a colony thruout the winter. This will perhaps do for small colonies. For strong colonies fifty pounds will be a better and safer estimate. Not only the quantity of winter stores, but also their quality must receive due consideration by the beekeeper. Winter stores and feeding are more fully discussed on page 19.

Spring Management. This has for its chief aims to rear a large number of worker bees in each colony, and to prevent swarming.

If the bees have had ample protection in the winter, they are likely to come thru in good condition, and it is better not to disturb them too early in the spring. However, they may have run short of stores, and therefore a superficial examination on a warm day is advisable. In case the stores are exhausted, the colony must be fed (see page 19). Colonies that have come thru the winter in a very weak condition should be united. A colony that does not have enuf bees to cover two frames should be united with a strong colony, (see uniting, page 19) to prevent robbing.

A careful examination of all the colonies should be made as soon as warm weather sets in to determine whether or not any colonies are queenless, and whether or not sufficient stores are present in the combs. A fertile and vigorous queen is recognized by the presence of a generous amount of evenly deposited worker brood. If there is a large amount of drone comb in a

hive, or if the colony is queenless, it should be united to a strong colony, taking the necessary precautions to prevent fighting. At this time of the year uniting a queenless colony with a strong one having a good queen is better than requeening. While queens may be secured from queen breeders located in the extreme Southern states; requeening is not advised for such colonies at this time because of the frequent delay in the delivery of queens. Weak colonies should never be made to rear their own queens, because such queens rarely render good service.

The colonies should now be examined from time to time when the weather permits. Care must, of course, be taken not to open the hives on very cool days because it may result in chilling of the brood and causing it to die. At this time the beekeeper should see that the brood nest expands properly. If necessary, he can aid in this process by a judicious spreading of the brood.

A very important need for the bees in spring is a constant and ample supply of fresh water. If there is no small stream near by, fresh water should be provided in some other way.

In some localities there is at times a dearth of pollen in the early spring when brood rearing is begun. Some authorities have recommended various kinds of flour or meal as a substitute for pollen. While the bees will greedily gather flour when pollen is not available this does not prove that it is a good substitute. As a matter of fact it is not, for the bees cannot digest the large amount of starch present in the substitutes. Moreover, in Arkansas where soft maples, elms, and willows are common all over the state, the bees will rarely if ever lack the required amount of pollen.

Swarming. Nature has given bees the instinct to swarm under certain conditions. It is the natural method of making new colonies, the perpetuation of the species. For this reason swarming cannot be eliminated. However, it can be largely controlled, and the losses due to swarming can be almost entirely prevented. When the bees get the desire to swarm they start a number of queen cells. Under favorable weather conditions the old queen with a large portion of the bees leaves the hive shortly before the first of the young queens emerges.

In the years past beekeepers have been in the habit of measuring their success in terms of swarms that issued during the season. At the present, however, success is based solely on the amount of surplus honey produced. The two do not go together; if a surplus is to be gained, swarming must be kept under control.

Swarm Control. In attempting to control swarming, one should know the cause. As stated above, the primary cause for

swarming is the instinct that prompts bees to leave the hive under certain conditions. Another way of stating this is that we don't know the primary cause of swarming. However, we do know what some of the contributing factors are when bees are swarming. These are principally crowding and overheating or lack of ventilation. Evidence that either of these fartors is at work is seen when the bees cluster on the outside of the hive. Since definite preparation for swarming is easily recognized by the appearance of queen cells, swarming can be to some extent prevented by examining the colony every seven days and destroying all the queen cells.

Clipping the Queen. By cutting off the wings on one side, one-eighth of an inch from the base, the queen is rendered unable to fly. A swarm, if it does issue, will not leave without the queen and is therefore easily hived. Clipping the queen is a very common practice and is usually done when examining the bees for the second time in spring.

More important, however, in swarm control is plenty of room. In spring when a heavy flow is on, and brood rearing almost at its height, one single story 10-frame hive does not provide enuf room for a strong colony. Supers or extra hive bodies must be provided as soon as needed. If there is a lack of room in the hive the bees get too hot because so many of them are moving around in the limited space. If there is a large number of young bees in the brood chamber, it gets too warm. All this creates discontent among the bees, a spirit that seizes also the field workers and causes them to remain at home, thus still more increasing the congestion. The discontent develops into the swarming impulse. By providing sufficient room, moving some of the brood into the upper story, or adding it to a weaker colony, and by providing proper shade, the congestion and overheating are prevented and the swarming impulse does not develop.

Even when the bees have the full entrance, (seven-eighths of an inch clear across the hive) which should always be given except in case when there is danger of robbing, on warm and sultry days they will cluster on the outside of the hive because of lack of proper ventilation. This is remedied by raising up the front end of the hive, from the bottom and inserting small blocks of wood about an inch thick.

The different manipulations that aid in swarm control, briefly summarized are in order of their importance; (1) providing plenty of room for brood and stores, (2) allowing for necessary ventilation by giving full entrance, and more if necessary, (3) clipping the queen's wings, and (4) examining the colony every 7 to 10 days and destroying all queen cells. This manipulation will probably be found necessary only if the

beekeeper produces comb honey. In the case of extracted honey the bees usually need to be disturbed only a few times during the summer.

Hiving a Swarm. If a swarm issues from a hive and is accompanied by the queen it usually settles in a tree nearby. Here it may remain for several hours. Apparently the bees do this in order to make sure that the queen is with them. Sometimes a colony in which the queen has been clipped makes an effort to get away, a large number of bees will leave the hive and some of them may settle in a tree nearby. However, they soon discover that the queen has remained behind and as a rule they speedily return to the hive.

A swarm, when it has settled in a tree, may easily be hived by removing it either by cutting off the twig on which the bees have settled or by shaking the swarm into a large sack. The bees are then shaken directly into a hive equipped with frames and full sheets of foundation. Sometimes bees settle on the trunk of a tree or in some other place from which they cannot easily be removed. In this case a branch of a tree or an inverted basket is placed over the swarm and with the aid of a little smoke the bees are induced to ascend into this branch or basket. Bees in the act of swarming are in a peacable mood and rarely cause much trouble to the operator. To make sure that the bees will not forsake the new hive it is well to place a wire entrance guard over the entrance and leave it there for the remainder of the day.

Artificial Increase. If an increase in the number of colonies is desired, this may be accomplished by allowing some of them to swarm, and hiving each swarm as it issues. This requires rather close attention, and even then the issuing swarm may get away.

A very common method of artificial increase is the one known as the "shaking" method. When evidences of swarming appear in a colony, the hive with its contents is placed to one side, and in its place is put a new hive equipped with frames and full sheets of foundation. The super is taken from the old hive and placed on the new hive. The combs are then taken from the old hive and the bees are shaken in front of the new hive.

The queen, of course, must first be located and placed in the new hive. By shaking her off she may easily be injured or lost. The old hive with the brood and some young bees is now put in another place. When shaking bees from off the frames it will be noticed that the young bees are not so easily shaken off as are the old bees. In order to give the brood proper protection it is well to leave a considerable number of young bees on the combs and return them to the old hive. If no bees are left with the brood in the old hive a large proportion of it may get chilled

or starve to death. To prevent robbing the entrance should be almost closed up with grass or weeds. The bees in this hive will care for the brood and also rear a queen, so that after about 21 days it will be a complete colony. A better plan than allowing the bees to rear a queen will be to give them a ripe queen cell, (one that has been capped over, and in which the queen is nearly ready to emerge). This will save considerable time, and furthermore, such a queen will probably be better than the one reared by a relatively small number of young bees.

Another method of artificial increase is to remove the queen and four or five frames with bees and brood and place them in a new hive in another location. The extra space in both hives is filled up with frames having full sheets of foundation. In the old hive, if none are present, a ripe queen cell should be given to the colony. If such is not available, the bees will rear a queen.

Uniting Colonies. If in the fall the beekeeper finds that some of the colonies have been dwindling and are not in the condition to winter well, he should unite them so as to form strong colonies. Nothing is lost by uniting; even if the number of colonies is decreased, the number of bees remains the same. There is this to gain: a weak colony may be robbed out in fall or early spring, while a strong one will not. A method of uniting very commonly used is the one devised by Dr. C. C. Miller. This method is essentially as follows: The poorer queen of the two, or the queen of the weaker colony is first killed. The cover is removed from the stronger colony, and two thicknesses of newspaper are placed over the hive so as to leave no openings. The hive with the weaker colony is now lifted from its bottom board and placed on the newspaper covering the stronger colony. The cover of the upper hive should be slightly raised, about one-sixteenth of an inch, to allow for a little ventilation. By the time that the bees work through the newspaper separating the two colonies, which may be 24-28 hours, they will have become "acquainted" and little or no fighting will take place.

Feeding. Feeding the bees often becomes necessary for various reasons. When bees are transferred to a new hive with nothing but full sheets of foundation because of foul brood, or for any other reason, they should be fed once or twice. Many beekeepers feed the bees in spring to stimulate brood rearing. Feeding is more especially important, however, in fall when the bees have failed to gather a sufficient quantity of honey to last them thru the winter. In the fall the stores should be carefully estimated and any shortage should be made up by feeding. A 10 frame Langstroth hive with bees, pollen, and combs, but without cover, is generally estimated to weigh about 30-35 pounds. So the approximate amount of stores is obtained by subtracting

30 pounds from the total weight of the hive including all but the cover.

Another simple method of estimating stores is to count the number of frames fairly filled up with honey, figuring five pounds of honey in one frame. Seven frames well filled are sufficient to maintain a small colony thruout the winter. If the colony is a strong one it must have more.

If the bees are well protected against cold weather they may in case of an emergency, be fed on mild days during the winter; but it is much better to feed them before cold weather sets in. If the bees have sufficient stores to last them thru the winter but not till the spring honey flow; feeding may be delayed until warm weather of spring sets in.

White honey from sweet clover or from holly, or from cotton is probably the best material for feeding provided the beekeeper is certain that the colonies that provide the supply are free from foul brood. A syrup made of 2 parts of granulated cane sugar to one part of water will serve very well for feeding. This syrup is prepared as follows: The mixture of sugar and water is heated to boiling in order to dissolve the sugar, then one ounce of tartaric acid to every 40-50 pounds of sugar is added. The acid inverts the sugar and retards granulation in the combs. When feeding is done in the summer in only a limited way a one-to-one mixture without the tartaric acid will do very well.

Various devices for feeding are offered among beekeepers' supplies. Among these the Doolittle division board feeder is perhaps the most commonly used. A tin can with a friction top into which a number of holes have been punched, when placed upside down on top of the frames inside of an empty super or hive body, answers the purpose. Another method of feeding is to put the syrup in a shallow dish or pan and place it on the frames inside of an empty super. To prevent any bees from drowning a number of small shavings are put in the syrup, or a cotton cloth is spread over the pan large enuf to drop over the edges of the pan. The cloth should be large enuf so it can drop to the bottom of the pan as the syrup is removed.

Robbing. During warm weather, especially when no honey is being brot in, bees are sometimes inclined to rob. Robbing is often caused by careless manipulations of the beekeeper. Leaving honey or combs exposed in the apiary may incite the bees to robbing. The same may take place during such tedious tasks as transferring bees from box hives.

Robbers are recognized by the fact that they enter the hive with the abdomen contracted, and leave with the abdomen distended flying straight home.

Robbing should be stopped at once by throwing a bunch of wet grass or weeds over the entrance of the attacked colony.

Any manipulations in progress should be stopped if possible.

Another method to stop robbing is to contract the entrance of the attacked colony to about a half an inch and wipe the front of the hive with a cloth dipped in kerosene or carbolic acid.

Colonies that have been weakened by disease, improper protection in winter, or queenlessness are likely to be robbed. This type of robbing is usually slow and done by one colony. The preventive here is not to maintain weak colonies.

Honey Production. For the beginner in beekeeping it is necessary to decide at the outset what kind of honey he wants to produce. The advantages and disadvantages of the two types, extracted and comb honey, deserve full consideration before the decision is made. To save the expense of an extractor which is needed in producing extracted honey, the beginner often decides in favor of comb honey. He overlooks the fact that to produce comb honey one must know bee behavior and must have more than a beginner's knowledge of beekeeping. Furthermore, comb honey can be produced with good results only in certain localities. In Arkansas the best localities for comb honey production are in the northeastern portion where there is an abundant growth of sweet and white clover; and in the southeastern and south central part of the state in the holly region. Besides these, certain localities in river bottoms are quite favorable for comb honey production.

This leaves a large portion of Arkansas which is not considered favorable for comb honey, because there is no honey flow that is exceedingly heavy. In most parts of the state there are several flows, as for instance in the northwestern portion, there is first the fruit bloom, then the sweet clover, and later in September the Bidens (Spanish needle). Taking these together they make possible a handsome profit for the beekeeper, but none of them is suitable for comb honey production. After the combs in extracting frames are once drawn by the bees they can be used again and again for a great many years, thus saving the bees the time and trouble of building combs.

These are decided advantages in favor of extracted honey. Furthermore, bees instinctively are disinclined to enter comb honey supers to build up combs and deposit honey in the sections. They must be forced in part by a very heavy honey flow and in part by clever manipulations by the beekeeper. The beginner will find it much easier to produce extracted honey than comb honey. A colony will yield about twice as much extracted honey as comb honey. This, however, is partly balanced by the fact that comb honey often brings a price considerably above that of extracted honey.

Extracted honey can be marketed at all seasons of the year, it is readily shipped, and will keep for many years. Comb

honey, at good prices, sometimes has but a limited and unsteady demand, it is rather fragile for shipping and difficult to keep. On the other hand, it must not be overlooked that comb honey is an article of luxury that appeals to certain people and in a suitable locality and under the proper conditions the production of it provides a very handsome income.

Extracted Honey. This is the product that is removed from the combs by means of a machine known as an extractor. The advantages of it over comb honey and some of the essential manipulations have already been given in the preceding paragraphs. For an extracting super an ordinary hive body may be used, equipped with the regular frames, fitted with full sheets of foundation and wired in the usual way. A shallow super holding frames only 5⅜ inches deep has some advantage over the full sized hive body, because it is not so heavy and therefore more easily handled. The shallow frames are fitted with full sheets of foundation and wired like the full sized frames. It insures straight combs and renders them strong enuf to withstand the extracting process.

To prevent the queen from depositing eggs in the super a queen excluder is placed between the brood chamber and the super. Until recently, a sheet of perforated zinc was most commonly used for this purpose, but it is now being rapidly displaced by the wire-and-wood excluder (preferably 7-wire) which allows the workers to pass thru more freely. If there is a tendency for the bees to swarm, the use of the excluder is quite a problem. In this case it will not be wise to use it immediately before nor during a strong honey flow unless the beekeeper is at the same time pursuing a method of swarm control which involves the use of the excluder. During the last few weeks of the honey flow the excluder should be used to rid the super of brood. In this case the beekeeper must, of course, make sure that the queen is below the excluder.

The supers are placed on the hives in spring just before the honey flow sets in, provided the colony is strong enuf to warrant the expectation of a surplus. Before the first super is entirely filled, it should be raised and another one placed underneath it. This encourages the storing instinct, gives the bees plenty of room, and discourages swarming. Supers should not be removed from the hive until the honey is well ripened, which means when all, or nearly all, of the honey has been sealed over.

In removing the supers of honey the bees may be brushed or shaken off, or the supers may be cleared of bees by introducing a bee escape 24 hours before they are to be removed. The honey may be extracted as soon as the supers have been taken off; it will extract more readily if it is not allowed to cool.

Before putting the frames in the extractor, the combs are

uncapped with a sharp knife that has been heated in hot water, or preferably with a steam heated knife. The uncapping is done over some vessel that receives the cappings. These are later melted up, or placed in a solar wax extractor.

Honey from different sources is often kept separate. This is especially important if there is a small amount of bitter weed honey, or some other honey with a disagreeable flavor. Extracted honey should be freed from particles of wax, either by straining it thru a cheese cloth, or allowing it to stand till the wax particles have all come to the surface. If stored in a dry place good extracted honey will keep for years.

Comb Honey. The production of comb honey can be handled successfully only by experienced beekeepers. Since this publication is intended for beginners in beekeeping this subject will not receive any further consideration here. Anyone who is interested may get the desired information by referring to Farmers' Bulletion 1039 (this may be secured by writing to the Experiment Station or to the U. S. Department of Agriculture).

Wax. Beeswax is an important by-product in the apiary, if the cappings cut off at extracting, scraps, and broken combs are rendered to wax. This by-product will perhaps pay for most of the bee supplies. Wax extractors and presses of various types are on the market. A simple method of extracting small quantities of wax is by the use of a shallow pan or dripping pan. A hole is made in one end of this pan, the wax is placed at the other end, and the pan is placed in the oven so that the hole in the pan is outside of the oven over some other vessel containing a small amount of water. The other end of the pan should be raised an inch or two so that the molten wax will drain thru the hole at the other end and drip into the water.

Wax rendered in solar extractors has a better color than when rendered as described above. A solar extractor may be bought from dealers in beekeepers' supplies for a reasonable price. It can easily be made out of two small dry goods boxes, a sheet of tin, and a piece of window glass. One objection to the solar extractor is that much of the wax remains in the combs after heating. This is especially true when old combs taken from diseased colonies are being rendered to wax.

Queen Rearing. If done on a large scale and for the purpose of supplying the trade this requires special training and experience. Several texts are available for those interested in the subject.

Italianizing. The beekeeper who has an apiary of black bees and can spare money more readily than time will perhaps do best to purchase Italian queens (untested) one for each col-

ony, and to introduce these at any time except in winter. (For methods of introducing queens see page 25). In this case untested queens are recommended for several reasons. In the first place they are cheaper than tested queens, and in buying a num-

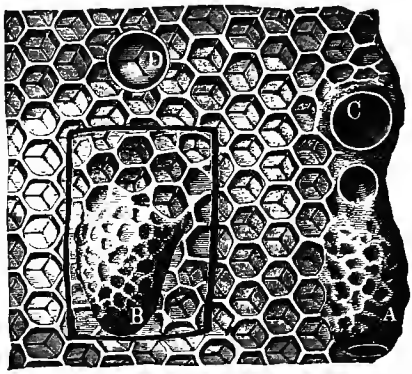


FIG. 3. A. Unsealed queen cell, B. Inserted cell, C. Unfinished cell, D. Cell just begun. (Electrotype furnished by Dadant and Sons.)

ber of them quite a saving can be made. Furthermore, if the queens are purchased from reliable breeders; they will almost always be as represented and produce only pure stock. Worthy of consideration is also the fact that tested queens are more likely to be injured while being shipped, than are untested queens. An untested queen is one that has mated and has begun to lay. A tested queen is one that is kept by the breeder for a little more than three weeks after she has begun to lay, when he is able to determine by the color of her worker offspring whether she is purely mated or not.

If the beekeeper has plenty of time he may Italianize his colonies by another method involving very little expense. By purchasing three or four tested Italian queens and introducing them in the most prosperous colonies, these will be italianized in about six weeks. After the main honey flow is over one or several of these colonies are selected for queen rearing. By making a colony queenless, the workers will be induced to rear queens. By examining such a colony about ten days after the queen has been removed often as many as ten or twelve queen cells can be found. When the queen cells have been sealed up they are carefully removed with a sharp knife from the combs, and one queen cell is then given to each colony to be requeened. Each of these colonies must be made queenless about 12 hours before the queen cells are introduced, otherwise the bees may not accept them. The cells are inserted in the combs by cutting out a place just large enuf to receive them and hold them in the

natural position (see Fig. 3.) The queen cells must be handled with great care, for the young larvae are easily injured. If all these virgin queens should mate with Italian drones the whole apiary would be italianized in a short time. However, even if, as is likely to happen, some of the queens mate with black drones, all the drones from the virgin queens will be Italian. Therefore, all that remains to be done to complete the italianization is to repeat the above procedure, preferably the following year. If by the use of a drone trap or removal of all drone comb, all the black drones are eliminated before the young queens emerge the requeening need not be repeated the second year.

Introducing Queens. One method, that of inserting mature queen cells has already been discussed. If it is preferred, the beekeeper may allow such queens to emerge before introduction, protecting each cell by a wire protector so that the one emerging first is prevented from killing all the others. A disadvantage of this method is that the introduction of virgin queens is a difficult matter and should not be practiced by beginners.

The most common method of introducing queens shipped thru the mails is to insert the mailing cage, between the combs following closely the directions accompanying the cage. This method usually is successful.

A very simple introducing cage can be constructed out of a small piece of screen wire. This is cut and bent in the form of a small tray, about three inches long, two inches wide, and three-fourths of an inch deep. The queen to be introduced is placed in this tray and covered with a thin piece of cardboard. a frame containing brood, eggs, and honey, or cells with pollen and honey is then brot into the house. The tray with the queen is put on the comb with the cardboard next to it where she is supplied with honey and pollen or brood. The cardboard is then drawn out and the edges of the tray are pushed into the comb for about a quarter of an inch. This is known as the push-into-comb method. The bees liberate the queen in 24-48 hours by tunneling thru the comb.

BEE DISEASES

American Foul Brood. Of the five diseases commonly known to affect bees, this is by far the most destructive. When it once gets into an apiary and is allowed to proceed unchecked it may in a few years destroy all the colonies. It is highly infectious and because of the tendency that bees have of robbing weak colonies, it often spreads rapidly from colony to colony and from one apiary to another.

American foul brood is caused by a pathogenic organism known as Bacillus larvae. It attacks the larvae (or young bees) in the cells when they are full grown. It is practically con-

fined to worker larvae, very rarely attacking drone larvae or queen larvae. The larvae when attacked by the disease loose their waxy white color and gradually assume a brown or coffee color. They usually die after the cells have been capped over. When the larvae fail to emerge the workers either remove the

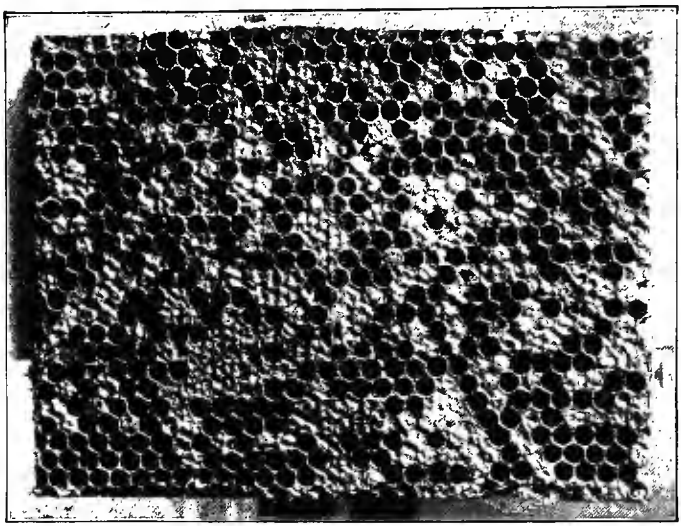


FIG. 4. American Foul Brood (Notice the sunken and scattered cappings) (Electrotype furnished by Dadant and Sons)

cappings or puncture them.

These punctures in the cell cappings, the large number of uncapped cells, the brown color of the larvae, and an odor somewhat like burnt glue, are indications of American Foul Brood. By inserting a toothpick in one of the dead larvae and drawing it out the material will often string out for an inch or more. This is known as ropiness. Ropiness is not present at an early stage of the disease; it develops after the larva has been dead for some time and has dried down to some extent.

American foul brood unlike European foul brood attacks all the different races and strains of bees.

Treatment. When proceeding to treat colonies for foul brood two things should be borne in mind. One is that the organism causing the disease is very difficult to kill. It takes 30 minutes to kill it in boiling water. In the combs the disease cannot be treated with disinfectants. The other thing is that all honey gathered while the disease is present in the colony is contaminated.

Therefore, the only treatment is to take all the infected

material from the bees and give them a new start, proceeding as follows: The hive with the infected colony is placed a little to one side, and in its place is put a clean or new hive with frames and full sheets of foundation. An extra hive body with cover is placed conveniently nearby. From the infected hive the frames are now removed one by one and the bees shaken off on a large sheet of newspaper placed in front of the new hive. This paper is burned up immediately after completing the shaking. Some care must be exercised to see that the queen enters the new hive. All infected material must be kept covered as much as possible. When shaking is completed all the infected material, hive bodies, combs, etc., is taken into the house where the bees cannot get at it. The honey may be squeezed out or extracted, remembering, of course, that it is infected and will contaminate everything with which it comes in contact. The combs may be rendered to wax. The hive bodies can be disinfected by scorching them to a uniform brown color with a plumber's torch. The frames if in good condition may be treated in a similar way after all the wax and propolis are scraped off, if it seems worth while; usually it will be found cheaper to burn them and get new frames.

Colonies should not be treated for foul brood unless some honey is coming in; even then it will be well to feed them on the first evening. If a strong flow is on it is not entirely safe to put the bees on full sheets of foundation as indicated above; it may be better to put them on starters for a day and then give them full sheets of foundation, altho this is generally regarded as unnecessary.

European Foul Brood. This is caused by a pathogenic organism known as Bacillus pluton. While it has caused as much trouble as has American foul brood, it is by many beekeepers not regarded as serious as that. The reason why it may cause very heavy losses is that it spreads very rapidly thru an apiary, often also thru a whole neighborhood. It is unlike American foul brood in this respect; the latter may spread quite slowly.

European foul brood attacks the larvae earlier in their development when they are still curled up in the cell. The diseased larvae take on a yellowish color. Later as the larvae begin to decay they assume a greyish color and a melted appearance.

Larvae that have died as a result of American foul brood are very adhesive, stick tightly to the cell; those affected with European foul brood are not so adhesive. This is important in treating diseased colonies. A slight ropiness is sometimes found in larvae affected with European foul brood. As long as no decay is present, they are practically odorless; as decay sets in, an odor of fermentation may be observed.

European foul brood attacks drone larvae and queen larvae as well as worker larvae. It is a disease that generally attacks weak or failing colonies. Some races of bees, such as the three-banded Italian, are able to resist the disease; others are not. The black, or German, bees are known to succumb very readily to the disease. It has been claimed that Carniolans are as resistant as Italians; apparently this statement needs further proof.

Treatment of European foul brood. Since this disease attacks weak colonies and especially certain races of bees, the building up of strong colonies consisting of resistant strains is recommended for treating as well as for preventing European foul brood.

It is suggested therefore, that colonies infected with European foul brood be united so as to make strong colonies, and requeened with good Italian stock.

Other Brood Diseases. Sacbrood. When affected with this disease the larvae die at about the time of sealing. The color of the dead larvae varies from yellow to brown or even black. The body is distended and the contents are watery during a certain period of the decay. There is no ropiness, and no characteristic odor. The disease seldom causes any very serious losses in the apiary, and as a rule the colonies recover without any treatment. The important consideration in regard to sacbrood therefore is that it is easily mistaken for American foul brood and the treatment is administered when it is entirely unnecessary.

Young bee larvae may die from other causes. If in the spring the honey flow suddenly gives out some of the brood may starve. If the beekeeper manipulates the combs carelessly and spreads the brood too much early in the season some of the brood may get chilled and the dead larvae will bear some resemblance to those affected with foul brood. Chilling the brood may also take place when the frames are handled on cold and windy days during early spring.

Diseases of Adult Bees. Dysentery is the only common trouble affecting adult bees. It appears generally in winter or early spring in those colonies that have winter stores consisting of honey dew or other such material which the bees cannot digest well.

ENEMIES OF BEES

Wax Moth. This is often known as "moths." The caterpillars or "worms" of these moths are commonly found in combs of weak colonies and combs that have been stored away. The damage caused by the "worm" consists in tunneling thru the combs and destroying the brood that may be in the way. The full grown caterpillar is about an inch long and yellowish white in color. When mature these caterpillars spin a silken cocoon

in some crevice or corner of the hive and after about ten weeks the adult moth appears. The adult is grayish-brown in color. It deposits eggs on the combs, or in cracks for a succeeding generation.

The wax moth, altho a pest, is at the same time an indicator of poor beekeeping. The progressive beekeeper who maintains *strong* Italian colonies in modern hives with movable frames is *never* troubled with wax moths.

If stored combs become infested with the wax moths they should be fumigated with carbon disulfide. This can be done by placing the infested combs in hive bodies, stacking these up and covering them with an oilcloth or blanket, making the whole, as nearly airtight as possible. The carbon disulfide, about a half cupfull to 6-7 hive bodies, is poured in a saucer placed on top of the frames. Carbon disulfide is highly inflammable and all danger of fire must be carefully avoided.

Ants. Various species of ants sometimes cause more or less trouble in apiaries, stealing honey, and sometimes killing brood. Strong colonies of bees will resist attacks by ants excepting the Argentine ant, which probably does not as yet occur in Arkansas. With the exception of this species, ants may easily be exterminated by use of carbon disulfide. A hole is made in the ants' nest by driving a stick into the ground. A small amount of carbon disulfide is poured into the hole, and it is quickly closed up by tramping down the soil to confine the gas as much as possible.

HONEY PLANTS

The white or silver maple (Acer saccharum) is probably the earliest source for honey in Arkansas. This year these maples came into bloom in the northwestern part of the state about February 1. The maples yield an abundant source of pollen and considerable nectar. Elms furnish a good source for pollen.

The blossoms of peach, cherry, and apple come late in March and early in April. In many parts of the state fruit bloom furnishes a large portion of the nectar supply. Dandelions (Taraxicum officionale) are in bloom at the same time and deserve to be mentioned among honey plants. Service-berry or shadbush (Amelanchier canadensis) is quite common in the woods; it comes into bloom late in March and furnishes a limited amount of nectar. During the middle of April the gums are in bloom. The sour gum or Tupelo, (Nyssa sylvatica) yields honey of excellent quality. The tree is fairly common in the southern part of the state. The sweet gum (Liquidambar Styraciflua) yields mostly propolis.

White clover (Trifolium repens) occurs over a large part of the state, but only in the northeastern section is it in suffi-

cient abundance to make comb honey profitable. It comes into bloom about the middle of May. Alfalfa (Medicago sativa) begins to bloom at this time. In the eastern part of Arkansas alfalfa perhaps produces little or no nectar, but in the western part it is believed to be an important honey plant. About this time holly (Ilex opaca) comes into bloom. It forms an excellent and abundant source of nectar in the southern part of the state. Persimmon, (Diospyros virginiana) common almost over the entire state, blooms during the latter part of May and early June. It is a valuable source of nectar supply. Black locust, tho not very common in some localities, furnishes a considerable supply of nectar during this time. Rattan vine (Berchenica scandens) locally very abundant especially in the central part of the state yields honey of rather dark color. It blooms early in May.

Sweet clover (Melilotus alba) begins to bloom early in June and often continues for a month or more. It is a very important source of nectar. Since it does well in Arkansas, and is a good forage crop the planting of it deserves very much to be encouraged.

Hairy Vetch blooms during May and June. It is grown as a forage crop to a limited extent. As a source of nectar it is well worth mentioning.

Cotton comes in bloom on about the middle of July and continues till frost. Since it yields a very considerable amount of nectar, and blooms when wild flowers and other honey plants are somewhat scarce, it forms perhaps the most important source for nectar in Arkansas. Cotton, as is probably well known, yields nectar not only thru the flowers but also thru the leaves. Nectar secretion in cotton depends on several factors. When grown on rich alluvial soil it yields large quantities, on thin land it may not yield any appreciable amount. It secretes rapidly in the early hours of the morning, late in the evening, and on cloudy days. The honey is of a light color. The flavor compares well with other good grades of honey.

Among the wild flowers of mid-summer the various species of Eupatorium (Thoroughwort) are in many localities of considerable importance. However, more so is Heartsease (Persicaria persicaria) which comes in bloom about the first of August. It yields honey of a fairly good quality, but of a rather strong flavor.

In the matter of fall flowers Arkansas is very fortunate. Beginning about September first, the fields and roadsides are covered with a tall yellow flowering weed, locally known as Spanish needles (Bidens involucrata). This weed yields a large amount of nectar. The honey is of bright yellow color, of good flavor, and entirely satisfactory for winter stores.

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